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QCD low x evolution and the onset of gluon saturation in exclusive photo-production of vector mesons

We investigate the energy dependence of the photo-production cross-section of vector mesons J/Ψ and Υ , which has been measured by both HERA experiments H1 and ZEUS in electron-proton collisions and by LHC experiments ALICE, CMS and LHCb in ultra-peripheral proton-proton and ultra-peripheral proton-lead collisions. Our study uses 2 particular fits of inclusive unintegrated gluon distribution, based on non-linear Baltisky-Kovchegov evolution (Kutak-Sapeta gluon; KS) and next-to-leading order Baltisky-Fadin-Kuraev-Lipatov evolution (Hentschinski-Sabio Vera-Salas gluon; HSS). We find that linear next-to-leading order BFKL evolution can only describe J/Ψ production at highest energies, if perturbative corrections are increased to unnaturally large values; rendering this corrections small, the growth with energy is too strong in the LHC region and the description of data fails. For the KS gluon we find that an accurate description of J/Ψ data is possible if non-linear corrections to low x QCD evolution are taken into account; without such correction a description of data fails. We interpret this observation as a clear signal for the presence of high gluon densities in low x the proton, characteristic for the onset of gluon saturation.

Primary authors: HENTSCHINSKI, Martin (Universidad de las Americas, Puebla); KUTAK, Krzysztof (Instytut Fizyki Jadrowej Polskiej Akademii Nauk)

Presenter: HENTSCHINSKI, Martin (Universidad de las Americas, Puebla)

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